Addendum to Accompany NBS TN 895

An Overview of Floor Slip-Resistance Research With Annotated Bibliography

by

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The following items should be added to Section F - Legal Aspects of the Floor Slip-Resistance Problem and the Present Status of Floor Slip-Resistance Specifications.

The titles of these items should also be entered in the appropriate locations of the bibliography.

F-6-a Fed. Test Method Std. No. 501a Method 7121, June 15, 1966.

This standard describes a method of test for the dynamic coefficient of friction, using the Sigler tester.

"1. Scope

This method is intended for use in determining the dynamic coefficient of friction of resilient nontextile floor coverings with relatively smooth surfaces. It is not intended for use on floor coverings with corrugated surfaces or with deep designs."

"3. Apparatus

The apparatus shall be as follows:

3.1 A slipperiness tester of the pendulum impact type as shown in figures 7121A, 7121B, and 7121C. The apparatus consists essentially of a pendulum on the lower end of which is attached a mechanical heel mounted in a frame so that a piece of rubber, leather, or other material is impacted onto and swept over the surface of the material being tested. A Sigler pendulum impact tester meets these requirements."

Then follows a detailed, well-illustrated description of the design, calibration and use of the Sigler tester.

F-10-a MIL-D-17951C (Ships), 5 June 1975, superseding MIL-D-17951B (Ships), 25 October 1961.

"Military Specification, Deck Covering, Lightweight, Nonslip, Silicon Carbide Particle Coated Fabric, Film, or Composite, and Sealing Compound"

"This specification is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense"

The items referring to slip-resistance are:

"3.7 Nonslip properties. When tested as specified in 4.3.6, the material shall show factors of friction not less than those shown in Table IV.

Table IV - Nonslip properties

Property	Contacting surface condition		
	Dry	Wet	Oily
Factor of static friction:			
Leather	0.60	0.60	----
Rubber	.60	.60	0.60
Factor of sliding friction:			
Leather	.40	.40	----
Rubber	.50	.60	0.30

and

"4.3.6 Nonslip Properties. The factors of friction of the deck covering against leather and rubber shall be determined, respectively. The leather shall be oak-tanned sole leather which has been sanded smooth with grade 0 garnet paper. The rubber shall be a vulcanized compound with a hardness range of 60 to 80 Durometer "A". Tests shall be made with the contact surfaces dry; wet with a solution of 4 percent sodium chloride in water; and oily, using SAE 10W oil at a temperature between 60° and 80°F. The leather and rubber shall be cut to a size 2 by 4 inches and mounted on a block of the same size. A load of 33 pounds shall be applied uniformly over the 2 by 4 inch block during the test. A pendulum-type tensile testing machine shall be used to measure the force required to move the weight block on the deck-covered surface. The moving jaw of the tensile testing machine shall be set to move at the rate of 7½ feet per minute. Approximately one cup of the salt water solution shall be poured over the deck covering surface in making the wet test. For the oil test the oil shall be applied to the center of the leather or rubber sample and on the deck covering surface sufficient to spread evenly over the entire surface. The nonslip properties shall conform to 3.7."

F-12-a MIL-W-5044C, 25 August 1970, superseding MIL-W-5044B, 24 February 1964.

"Military Specification, Walkway Compound, Nonslip, and Walkway Matting, Nonslip"

"1. Scope

1.1 Scope. This specification covers nonslip walkway materials.

1.2 Classification. Walkway materials shall be of the following types, as specified (see 6.2).

Type I Coating, smooth texture (without grit) (primarily for brush application).

Type II Coating, rough texture (with grit) (primarily for brush application).

Type III Matting (for use with separate liquid adhesive)

Class I -Fine Grade
Class II -Medium Grade
Class III -Coarse Grade

Type IV Conformable matting (pressure sensitive adhesive applied)"

The references to slip resistance are as follows:

From Table I, Physical Characteristics

Property	Type I	Type II	TYPE III			Type IV
			Class I	Class II	Class III	
Factor of sliding friction (leather)						
Dry (min)	0.45	0.50	0.60	0.60	0.60	0.60
Watered (min)	0.60	0.80	1.00	1.00	1.00	1.00
Oiled (min)	0.20	0.45	0.60	0.60	0.60	0.60
Factor of sliding friction (rubber)						
Dry (min)	0.80	0.90	0.80	0.80	0.80	0.80
Watered (min)	0.80	0.80	0.80	0.80	0.80	0.80
Oiled (min)	0.35	0.60	0.60	0.60	0.60	0.60

"4.6.9 Factors of sliding friction

4.6.9.1 Specimen. Three 1/16 by 8 by 18 inch panels of each type, prepared as described in 4.6.1 shall be used.

4.6.9.2 Apparatus. Two pieces of sole leather conforming to KK-L-165, 1/4 by 1/2 by 10 inches, shall be so bonded to a block of maple wood 1 by 5 by 10.5 inches that the leather strips extend lengthwise symmetrically and 4 inches apart on the 5 by 10.5 inch face of the block. A thin brush coat of fuel and oil resistant adhesive conforming to MIL-A-5092, Type III, shall be applied to the 1/2 inch width of the leather skin surface and to the wood block and allowed to dry to the touch. A second coat shall be applied and dried. Both cement coated surfaces shall be wetted with the adhesive solvent and the surfaces bonded together when tacky. The adhered sections shall be rolled, and the assembly clamped firmly in a vise for 24 hours before use. The friction surfaces (flesh) shall be slightly buffed to assure uniformity. Five additional block assemblies, two with leather strips and three with rubber strips conforming to MIL-R-6855, Class II, Grade 80, shall be prepared similarly. Before each test run, the leather strips shall be sanded with 2/0 garnet paper and wiped clean of sanded particles with a cloth; the rubber strips shall not be sanded but wiped clean with a cloth. The table on which the test runs are made shall be level in all directions.

4.6.9.3 Procedure. The wooden block shall be weighted to a total load of 20 pounds, and a sufficient length of flexible steel cable conforming to MIL-W-1511 shall be attached to the wood block. The cable shall be so connected to the testing machine that it applies the load parallel to the walkway panel. Figure 2 shows schematically the apparatus used. The 20 pound weighted block shall be placed at the far end of the test panel, and the load required to pull it 7 inches across the panel at a speed of 20 inches per minute shall be recorded autographically. It shall be noted that load oscillations between static and dynamic friction could be minimized by momentarily holding the pendulum arm at the approximate average load and then releasing the arm. This usually produces more uniform recorded values. Friction tests shall be conducted on dry, watered and oiled surfaces. Oil used shall be Medium No 1 of Federal Test Method Standard No 601, Method 6001. Water and oil treating of the walkway surface shall consist of wetting the walkway and the friction block surfaces with approximately 200 to 300 milliliters of liquid, depending upon the type of surface. Separate panels shall be used for dry, watered, and oiled surface conditions. Friction blocks and dry conditions shall not be interchanged because of oil and water absorbed by the leather and rubber. Three runs shall be made on each specimen and averaged. Each run shall be made on an unused portion of surface of the test specimens.

4.6.9.4 Calculation. The starting load or static coefficient of friction shall not be considered in the test. The average dynamic load shall be determined from the autographic load recorded by the testing machine. Apparent factor of sliding friction shall be calculated as follows:

$$\text{Apparent factor of sliding friction} - \frac{\text{Average load recorded by testing machine}}{\underline{1}/ \quad 20 \times 2}$$

1/ Factor of 2 is used to correct for mechanical advantage of pulley system.

Value of 20 is total weight in pounds of the block and added load."

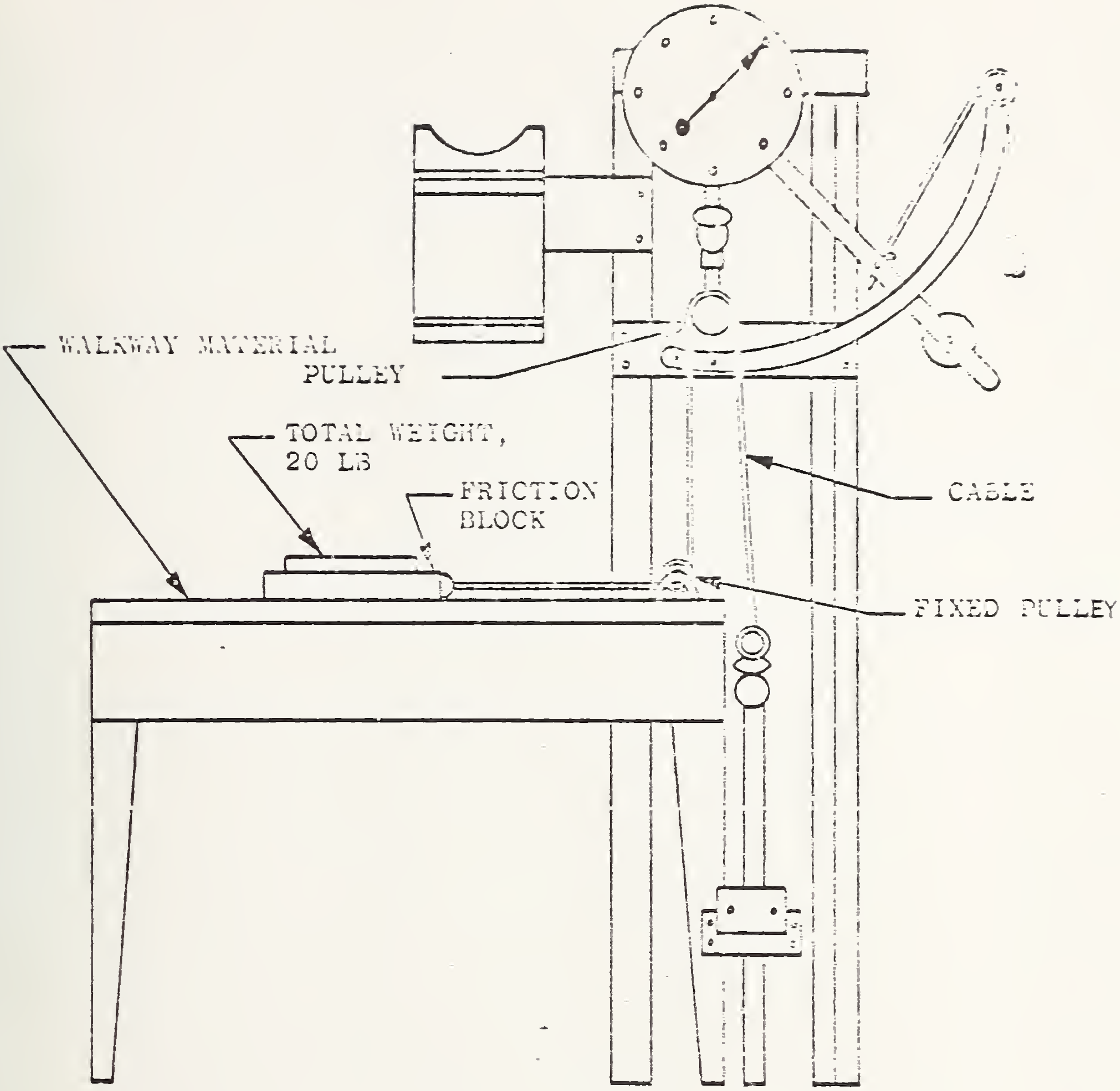

FIGURE 2. Sliding friction apparatus.